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Summary of Response To Detailed Action

Petition to Patent Examiner, Ruth A. Davis

Referring to Office Action Summary date mailed 06/24/2003 regarding patent application serial number 09/888,741, filed by Gene E. Lightner 06/25/2001 response to Office Action is enclosed within, and is referred by numbers within the Office Action Summary.

It is understood that a statutory period for reply to this final action is set to expire three months from the mailing date of this action.

Amended claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention are presented within this response to Detailed Action.

Dependent claims, within the present specification, have been amended and refer to claim 1, and so avoid confusion. Moreover independent claim 1, within the present invention, is amended to clarify the intention of this claim without altering the scope or intention of the application. Objective of amended claim 1 is accordingly apparent.

Prior art, disclosing teachings previously known, is superfluous to the present invention. The object of prior art, as presented by the examiner, is incidental to claim 1 within the present invention.

Remarks conclude that prior art cited is groundless within the present application. Accordingly the present invention is both novel and unobvious.

As stated, within the Detailed Action Summary, claims 1-19 stand rejected and action is final.

It is expected that, upon examination of the preceding explanations, all claims will be allowed by the examiner.

Separate clean copies (three pages) of all claims and specification, page 5 are included.

Respectfully,

Gene E. Lightner

Gene E. Lightner

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Response To Office Action Summary

Petition to patent examiner Ruth A. Davis

Referring to Office Action Summary date mailed 06/24/2003 regarding patent application serial number 09/888,741, filed by Gene E. Lightner 06/25/2001 response to Office Action is enclosed within, and is referred by numbers within the Office Action.

Pertaining to the applicant amendments filed 3/16/2003, these amendments are superseded by the present amendments.

1. Regarding the quotation from the second paragraph, of 35 U.S.C. 112: "The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention." Quoting from page 5, lines 12-14, as amended, within the specification of the present application, "In the preferred embodiment of the present invention, as claimed within claim 1, means of producing water soluble carbohydrates derived from lignocellulose is presented. The water soluble carbohydrates are derived by hydrolysis of cellulose contained in a lignocellulose by enzymes." Accordingly the specification has been amended to meet the requirements of U.S.C. 35 112, second paragraph.

2. Regarding rejection of claims 1-19 under U.S.C 35 112, second paragraph, please consider the quotation within the amended specification, as quoted, page 5, lines 12-14, "In the preferred embodiment of the present invention, a means of producing water soluble carbohydrates derived from lignocellulose is presented, The water soluble carbohydrates are derived by hydrolysis of cellulose contained in a lignocellulose by enzymes, as claimed within claim 1. Thus the specification has been amended to meet the requirement of U.S.C. 35 112, second paragraph.

Concerning claims 1-19 drawn to a method for producing water soluble carbohydrates. Specification, page 5, lines 20-23 is amended to clarify the intention of **Fig. 1**, without altering the scope or intention of the application. For reference, page 5, line 19 is provided.

Referring to **Fig. 1**, lignocellulose **10** is conveyed to hydrolysis stage **12** and combined with enzymes **14** and subjected to hydrolysis. Hydrolysis residue **22**, containing water and constituents from hydrolysis stage **12** is conveyed to filter stage **24** and filtered to produce filtrate **28** and filtered residue **26** conveyed to extract stage **30** Filtered residue **26** is extracted by water **34** to produce extractate **36** and extracted residue **32**. Extractate **36**, containing water, is conveyed to hydrolysis stage **12**, to provide water and extracted constituents for hydrolysis.

It is well known that water is consumed from the practice of hydrolysis and this amended specification is presented to establish significance of water within hydrolysis.

Claims 2-19 are dependent on newly presented amended independent claim 1. Claim 1, within the present invention, is amended to clarify the intention of this claim, without altering the scope or intention of the application. Claim 1 is amended from claim 1 presented within the original application, so as maintain scope, provide consistency and thus avoid confusion.

What is claimed is:

1. (amended) A method to produce water soluble carbohydrates from cellulose contained within, a lignocellulose,
which comprises:
providing a lignocellulose, and
providing a membrane to divide a filtrate containing enzymes, and
providing enzymes, recycled from said membrane, to said lignocellulose containing cellulose, and
combining [the] extractate, from a previous extraction, containing water soluble carbohydrates and enzymes, with [said] cellulose contained within lignocellulose, and
[subjecting said cellulose contained in lignocellulose to hydrolysis] hydrolyzing cellulose contained within lignocellulose combined with enzymes recycled from said membrane and extractate at a pH of about 5, [by said enzymes] to create [said] water soluble carbohydrates and to produce a lignin residue containing water soluble carbohydrates and enzymes, and
[filtering] removing said residue containing lignins from [said] hydrolysis [water soluble carbohydrates containing enzymes] and filtering said residue containing lignins to produce a filtrate and a filtered residue, and
extracting the filtered residue containing lignins with water to substantially extract water soluble carbohydrates and enzymes from the residue to produce a water extracted residue and an extractate for recycle for additional hydrolysis, and
employing said membrane to substantially divide said filtrate containing water soluble carbohydrates and enzymes to provide water soluble carbohydrates substantially devoid of enzymes and provide recycled enzymes for hydrolysis of cellulose contained in [said] lignocellulose thereby water soluble carbohydrates substantially devoid of enzymes are [formed] derived from lignocellulose and a residue containing lignins substantially devoid of water soluble carbohydrates and enzymes is [formed] the result of extraction to produce an extractate containing enzymes for recycle for additional hydrolysis.

Thus claim 1 is amended to overcome objections of clarity, and provides (, and) rather than enumeration, to clearly specify each step of the method.

It is made clear that hydrolysis of lignocellulose by enzymes produces water soluble carbohydrates. Furthermore, hydrolysis forms a lignin residue for filtering. This procedure is declared within amended claim 1.

Regarding claims 5 and 7, dependent on claim 1, are amended for clarification and to establish a suitable Markush group within each claim, as presented.

5. (amended) The method of claim 1 wherein said lignocellulose is obtained from biomass selected from the group consisting of wood, waste paper and municipal solid waste [including an individual or a combination thereof].

7 (amended) The method of claim 1 wherein [said] enzymes are selected from the group consisting of cellulase, glucanhydrolase and, cellobiohydrolase [including an individual or a combination thereof].

Accordingly claims 5 and 7 have been amended to become limitations within amended claim 1.

Regarding claim 7, as amended, this claim is dependent on amended independent claim 1 and so is applied to amended claim 1., which refers to enzymes with intended function. For further clarification, the position that all enzymes are obtained by recycle has been established. In addition, each Markush group is explanatory as well as providing limitations within amended claim 1.

In regard to claims 10-12, and 14-15, formation of water soluble carbohydrates derived by hydrolysis of lignocellulose is established and clarified within amended claim 1.

Dependent claims 10-12, and 14-15, with amendments, clarify the term "said water soluble carbohydrates ", by deleting "said" and referring to the source of water soluble carbohydrates, limitations within amended claim 1, are contributed.

10. (amended) The method of claim 1 wherein [said] water soluble carbohydrates, derived by hydrolysis of cellulose within lignocellulose, contain glucose.

11. (amended) The method of claim 1 wherein [said] water soluble carbohydrates, derived by hydrolysis of cellulose within lignocellulose, contain glucose polymers.

12. (amended) The method of claim 1 wherein [said] water soluble carbohydrates, derived by hydrolysis of cellulose within lignocellulose, contain cellodextrins.

14. (amended) The method of claim 1 wherein [said] water soluble carbohydrates, derived by hydrolysis of cellulose within lignocellulose containing enzymes are absorbed by cellulose to provide absorbed enzymes for hydrolysis of cellulose contained in a lignocellulose.

15. (amended) The method of claim 1 wherein [said] water soluble carbohydrates, derived by hydrolysis of cellulose within lignocellulose, are subjected to further hydrolysis to form glucose.

In regard to claim 13; line 1 is amended to stipulate the function of enzymes derived by ultrafiltration so that the term "said" is absent from claim 13, as amended.

13. (amended) The method of claim 1 wherein [said] enzymes derived from ultrafiltration are recycled to provide enzymes for hydrolysis of [said] cellulose contained within a lignocellulose. Thus the intent is clear that enzymes are provided as defined within **Fig. 1** and amended claim 1. Furthermore recycle of enzymes for additional hydrolysis is established within amended claim 1.

Considering the steps presented by the examiner. These steps contain certain features similar to ones within amended claim 1, but are unneeded because these steps enumerate contents within dependent claims and so impose unwanted limitations on amended claim 1. Accordingly the examiner is referred to amended claim 1. and steps presented by the examiner are declined. Furthermore previously supplied claims, by the applicant, are to be withdrawn and replaced with newly presented amended claims without changing intent or scope of the claims.

3. Regarding the quotation of paragraph a within 35 U.S.C. 103(a), "A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art in which said subject matter pertains.

Patentability shall not be negated by the manner in which the invention was made.

4. Referring to rejection of claims 1-19, as being unpatentable, within the present invention. As previously quoted, 5 U.S.C. 103(a), is inappropriate to amended claims 1-19, over Toreget, et al., Chahal and/or Liaw, et al.

Pertaining to the teaching of Toreget, et al., the practice of acidic hydrolysis of biomass to produce lignocellulose is presented. In addition, this teaching, specifies hydrolysis of hemicellulose, contained by a biomass and within column 1, lines 46-47, D-xylose and other pentoses. By hydrolysis, unhydrolyzed lignins are formed, this result is well known, and unrestricted to the teaching of Toreget, et al., as disclosed within column 13, lines 12-14.

The enzymes described by Toreget, et al., are employed for a well known procedure termed "simultaneous saccharification and fermentation" In addition, Toreget, et al., within column 14, lines 29-40, describes the technique of simultaneous saccharification and fermentation. Thus enzymes described by Toreget, et al., are utilized to hydrolyze lignocellulose to form glucose. Production of lignocellulose from a biomass substantially devoid of hemicellulose, filtration and fermentation of glucose to produce ethanol, are well known procedures and repeated within the teaching of Toreget, et al

Claim 1, presented by Toreget, et al., specifies steps carried out in order. These steps are substantially different than steps presented by the method of amended claim 1 within the present application.

Considering teachings presented by Chahal. Within the abstract and claim 1, it is unclear how hemicellulose is fractionated from cellulose contained by a biomass in view of the fact that lignin as a "glue" joins cellulose and hemicellulose in a continuous mass. Generally hemicellulose is removed from cellulose by hydrolysis, resulting in pentoses and glucose, so that hemicellulose as such, lacks legitimacy as a comprehensive polymer. Perhaps the translation performed for Chahal is so literal that the meaning is lost in English. In any event, teachings presented by Chahal are lacking application within amended claim 1 of the present application.

Regarding teachings presented by Liaw, et al., in which a liquefied starch solution is subjected to hydrolysis enzymatically for saccharification and formation of celodextrines. Furthermore a microfiltration step is claimed followed by subjecting resulting permeate to an ultrafiltration step. Also reference of filtering lignins is lacking. Teachings presented above are more or less contained within dependent claims of the present invention and these teachings are regarded as inapplicable to amended claim 1.

To one of ordinary skill in the art, motivation to apply a single or combination of the above references is evidenced by failure of implementation to the current case and so, reasonable expectation for "providing water soluble carbohydrates" is absent from these teachings.

In conclusion, a combination of cited prior art, which is lacking extraction of residue with recycle of resulting extractate to provide water and recovered enzymes for hydrolysis. Thus one of ordinary skill in the art is lacking purview for application to the current case. Accordingly, the current invention is both novel and unobvious. Therefore assertion that claim 1, as amended within the present invention, is unpatentable is rejected.